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ABSTRACT

The National Commission on the Financing of Post Secondary Education (NCFPE) has developed a model of student response to alternative financing plans, and has used this computor model to evaluate several alternatives in terms of enrollments and costs. The model predicted enrollments by types of institutions and family income and costs based on the changes in "price response"--the changes in the number of students who attend an institution based on its tuition, fees, and other costs. Thus enrollment would be expected to increase if the costs to the student--price were lowered and enrollment would be expected to decrease if the costs to the student price were increased. Two models were developed from the NCFPE model. This document provides the results of using those models with several alternatives interpretations of the general policy of "low tuition." While the results can themselves be useful to the discussion of alternative financing plans, they are intended as an example of using these improved models at two levels of interest. These models, like many others, depend on the student's response to the change in the "price" of postsecondary education. A brief summary of this concept and data bearing on this issue are included as an appendix. (Author/KE)

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EXAMPLES OF THE USE OF NATIONAL AND STATE POSTSECONDARY EDUCATION FINANCING MODELS

A Technical Paper by Systems Research Inc.
Los Angeles, California

NOTE: This technical paper was prepared as background material for the National Conference on Postsecondary Financing, January 15-17, 1975, Washington, D.C.

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FOREWORD

Included in the programs for the regional conferences on postsecondary financing were demonstration sessions on the use of models, their capabilities and limitations. Primarily, during these sessions two models, both developed from the model of the National Commission on the Financing of Postsecondary Education, were discussed. Some of the participants suggested that these models should be used to explore the alternative of stable or decreasing tuitions at both the national and state levels.

This report provides the results of using those models with several alternative interpretations of the general policy of "low tuition". While the results can themselves be useful to the discussion of alternative financing plans, they are intended as an example of using these improved models at two levels of interest.

These models, like many others, depend upon the student's response to the change in the "price" of postsecondary education. A brief summary of this concept and data bearing on this issue has been included as an appendix.

Because of the use of models in support of several of the major task force and commissioner reports on policy direction for postsecondary financing, during the regional conference series considerable interest was expressed in the variety of uses for models. Accordingly, the policy analysts at Systems Research Inc., Los Angeles, California, were asked to develop a ...ical paper with some assessment relative to model use.

And, as background information we are glad to distribute the model use and assessment paper for background information purposes to persons attending and interested in the National Conference on Postsecondary Financing, January 15-17, 1975 in Washington, D.C.

---Robert F. Corcoran
Education Commission of
the States

INTRODUCTION

The Model of the National Commission

As part of its analytic framework, the National Commission on the Financing of Postsecondary Education (NCFPE) developed a model of student response to alternative financing plans, and used this computer model to evaluate several alternatives in terms of enrollments and costs. The model predicted enrollments by type of institution and family income and costs based on the changes in "price" to a student resulting from alternative financing plans. The underlying economic concept was "price response"--the change in the number of students who attend an institution based on its tuition and fees and other costs. Thus enrollment would be expected to increase if the costs to the student--"price"--were lowered, and enrollment would be expected to decrease if the costs to the student--"price"--were increased.

As expected, students from families with low incomes are more responsive to price than students from higher incomes. As the price increases proportionately more students fail to enroll or "drop out" from lower income families than from higher income families. The NCFPE used price response coefficients based on a 1966 study of high school students attending and not attending college. For example, 3.26% of the low income students attending private institutions at the lower division would be expected to "drop out" of that category of institution if the tuition were increased $100, yet only 0.71% of the high income students attending such institutions would be expected to "drop out" if tuition were increased $100. It was similarly identified that 1.27% of the low income students would attend other types of institutions, primarily public two-year institutions, and

0.25% of the high income students would attend other types of institutions, primarily public universities. The price response coefficients used by NCFPE are given in Table 1.

The use of the NCFPE model for evaluation raised several types of issues: the current validity of price-response coefficients derived in 1966, the effects of inflation and recession and the impact of stabilizing enrollments and "new students". (See report of the National Commission on the Financing of Postsecondary Education.)

Extension of the Model

Further development of the model was undertaken by the Office of the Assistant Secretary for Education, Department of Health, Education and Welfare, and the Illinois Board of Higher Education. The Office of the Assistant Secretary suggested expansion of the model to include price-response coefficients by student ability (College Entrance Examination Board and American College Testing test score), additional institutional categories (up to 12) and refinement of the mathematical representation.

The Illinois Board of Higher Education had a somewhat more difficult task. In addition to examining changes on the national level, it was important to represent the enrollments of Illinois and the effects of state policy. This is not a simple representation of the state alone, since national policy impacts Illinois students as well. The model then becomes similar to the national model plus a state model and operates in two steps. These modifications were made to the model and data was developed for Illinois. The model was called the State Higher Education "Access" Financing Model and was used to support committee study of the financing of public community colleges and public institution tuitions in Illinois.

These two models were used in developing the results of evaluating the "low tuition" policy.

Table 1A - Price Response Coefficients for Low Income Students (<7,500)*

Institutional Category	Institutional Category								
	1	2	3	4	5	6	7	8	9
1	-2.95	0.32	0.0	0.0	0.22	0.16	0.0	0.0	0.22
2	0.51	-3.13	0.0	0.0	0.22	0.16	0.0	0.0	0.22
3	0.0	0.0	-3.13	0.0	0.0	0.0	0.16	0.0	0.0
4	0.0	0.0	0.0	-3.13	0.0	0.0	0.0	0.16	0.0
5	0.51	0.32	0.0	0.0	-3.24	0.16	0.0	0.0	0.22
6	0.51	0.32	0.0	0.0	0.22	-3.26	0.0	0.0	0.22
7	0.0	0.0	0.32	0.0	0.0	0.0	-3.26	0.0	0.0
8	0.0	0.0	0.0	0.32	0.0	0.0	0.0	-3.26	0.0
9	0.51	0.32	0.0	0.0	0.22	0.16	0.0	0.0	-3.24

*Price response coefficients (α_{ijm}) represent the percentage change in enrollment given a $100 price increase. Taken from Ref. 2, page 54.

Institutional Categories

(1) Public two-year
(2) Public four-year, lower division
(3) Public four-year, upper division
(4) Public four-year, graduate
(5) Private two-year
(6) Private four-year, lower division
(7) Private four-year, upper division
(8) Private four-year graduate
(9) Non-collegiate

Table 1B - Price Response Coefficients for Middle Income Students (7,500-15,000)*

Institutional Category	Institutional Category								
	1	2	3	4	5	6	7	8	9
1	-1.23	0.15	0.0	0.0	0.09	0.13	0.0	0.0	0.09
2	0.13	-1.22	0.0	0.0	0.09	0.13	0.0	0.0	0.09
3	0.0	0.0	-1.22	0.0	0.0	0.0	0.13	0.0	0.0
4	0.0	0.0	0.0	-1.22	0.0	0.0	0.0	0.13	0.0
5	0.13	0.15	0.0	0.0	-1.28	0.13	0.0	0.0	0.09
6	0.13	0.15	0.0	0.0	0.09	-1.24	0.0	0.0	0.09
7	0.0	0.0	0.15	0.0	0.0	0.0	-1.24	0.0	0.0
8	0.0	0.0	0.0	0.15	0.0	0.0	0.0	-1.24	0.0
9	0.13	0.15	0.0	0.0	0.09	0.13	0.0	0.0	-1.28

*Price response coefficients (α_{ijm}) represent the percentage change in enrollment given a $100 price increase.

Table 1C - Price Response Coefficients for High Income Students (>15,000)*

Institutional Category	Institutional Category								
	1	2	3	4	5	6	7	8	9
1	-0.75	0.09	0.0	0.0	0.05	0.09	0.0	0.0	0.05
2	0.06	-0.71	0.0	0.0	0.05	0.09	0.0	0.0	0.05
3	0.0	0.0	-0.71	0.0	0.0	0.0	0.09	0.0	0.0
4	0.0	0.0	0.0	-0.71	0.0	0.0	0.0	0.09	0.0
5	0.06	0.09	0.0	0.0	-0.76	0.09	0.0	0.0	0.05
6	0.06	0.09	0.0	0.0	0.05	-0.71	0.0	0.0	0.05
7	0.0	0.0	0.09	0.0	0.0	0.0	-0.71	0.0	0.0
8	0.0	0.0	0.0	0.09	0.0	0.0	0.0	-0.71	0.0
9	0.06	0.09	0.0	0.0	0.05	0.09	0.0	0.0	-0.76

*Price response coefficients (α_{ijm}) represent the percentage in enrollment given a $100 price increase.

THE "LOW TUITION" POLICY

Defining "Low Tuition Policy"

Several persons attending the regional conferences as well as conference series sponsors have been critical of proposals to increase tuition. The views of one sponsor are included in their statement, "Financing Reports and the Attack on Low Tuition" contained in the conference series conference handbook. Their statement contains three points: (1) a belief that there are sufficient additional resources to pay for the rising costs of education without charging middle-income and working-class students much more; (2) an opinion that low-income and disadvantaged students would suffer more from increased tuition; and (3) an observation that the appropriate financing plan is, of course, a political judgment.

At the regional conference, held on the Notre Dame campus, data from the Illinois Board of Higher Education's use of their model, based on a report made, supported the opinion that low-income and low-ability students would benefit more from a policy of stable tuition in a period of inflation. The conference participants focused on the definition of "low tuition" since the phrase could have different meaning. There appeared to be three definitions: current tuitions with increases corresponding to inflation (constant real dollar tuition), current tuitions with no increases (a decrease in real dollar tuition because of inflation), and some moderate decrease in tuitions (decreased real dollar tuitions).

The evaluation of the "low tuition" alternative can then be expressed in terms of the number of students enrolled, the proportion from different family income levels and the cost increments to the federal, state and

local governments. The evaluation does not include any direct measure of benefits to society or the individual, though rates of return on the educational investment have been estimated by Schultz (see Reference #4).

The national and state models were used to test these three alternative financing plans to get better insight into the results and costs of such a policy. While the NCFPE investigated a number of financing plans, the "low tuition" policies as discussed in the regional conferences were not included. Since the models were derived from NCFPE models and are compatible with it, the results can be compared with the NCPFE model, but not as used by the commission. The enrollment projections used for the models in this evaluation are more recent and different from those used by the NCFPE. While the price response coefficients are almost identical, they have been classified differently to include student ability. For these reasons the predicted enrollment changes will be somewhat less in this report than if either these models or the NCFPE model were used with the enrollment projections available in 1973 when the commission did its work.

ANALYSIS AT THE NATIONAL LEVEL

The Alternatives

Three alternative interpretations of "low tuition policy" were used to identify the likely changes which would result. They are holding public tuitions fixed (in actual dollar value), holding both public and private tuitions fixed and reducing tuitions by 10% per year during a period of inflation. These three alternatives would provide some perspective on financing which both included and excluded the private institutions, and a policy of reducing tuitions.

While it is hazardous to project a rate of inflation for the next five years, an annual rate of 8% was selected. This appears reasonable for both costs and tuitions at colleges and universities the past three years, although tuitions appear to now be increasing faster than costs at public institutions. Table 2 shows the expected tuition, based on reported tuitions in 1972. These projected tuitions were those used for the analysis. Similarly it was assumed that the cost per student to the institution would also rise at 8% per year. The three alternatives are summarized in Table 3.

Using this assumption about inflation, the price response coefficients of the NCFPE as modified for the Office of the Assistant Secretary for Education, and the base enrollment projections of the National Center for Educational Statistics (NCES), the national model was used to produce predicted values for 1976 and 1980. The values assume, of course, that institutional policies would not change significantly during this period to influence student enrollment preferences.

Table 2 - Projected Tuition at an 8% Annual Increase

Type of College or University	Base 1972	Estimated 8% Inflation 1974	1976	1980
Two-year	200	233	272	320
Public	465	542	633	861
Private	1,725	2,012	2,347	3,193

Table 3 - "Low Tuition" Alternatives

	Tuition Change per Year Public	Private
1. Base	+ 8%	+ 8%
2. "Low" Public Tuition	0	+ 8
3. "Low" Tuition	0	0
4. "Lowering" Tuition	-10	-10

The projected base enrollments--assuming no changes--are given in Table 4. The impact of the financing plans are measured against these projections made by NCES. The total enrollment changes in 1976 for the three financing plans are given in Table 5 and the percent enrollment changes are given in Table 6. This summary shows that the projected enrollment increases from the base enrollment would be 30,512, 65,741 and 105,188 students for the three alternatives in 1976, a percentage increase of 0.36%, 0.78% and 1.25% respectively. There are two reasons why these percentages may be less than one might expect. First, a large part of the student enrollment is in public community colleges and public colleges and universities which have low tution. Therefore, a 8% increase is much less than $100, so that the percentage change would be less than the price coefficient itself. Second, many students change categories of institutions rather than "drop out", as shown by the indirect price coefficients. As tuition increases, in general, some students from private colleges and universities will attend the public colleges and universities, some public college and university students attend community colleges and some of the community college students "drop out". Similarly as tuition remains constant, or is reduced, the shift occurs toward the private colleges and universities. The magnitude of these shifts can be seen in Table 5.

The percentages in Table 6 show the net effect of shifts in student enrollments with almost all changes in public institutions less than 0.5%; the large percentage changes occur in the private colleges and universities.

Similar data is provided in Tables 7 and 8 for 1980. Because a policy of no tuition increases during a period of inflation would reduce the real tuition further as time passed, the effects of the policy by 1980 are

Table 4 - Projected Base Enrollments

	1976	1980
Community Colleges	1,651,982	1,705,983
Public Colleges and Universities		
Lower Division	2,150,402	2,220,416
Upper Division	1,537,291	1,587,301
Graduate I	184,018	187,021
Graduate II	571,098	593,104
Total	4,442,809	4,587,842
Private Colleges and Universities		
Lower Division	1,183,104	1,222,110
Upper Division	687,051	710,049
Graduate	434,029	447,027
Total	2,304,184	2,379,186
Total Enrollment	8,398,975	8,673,011

Table 5 - Enrollment Changes, 1976 -- from Base Projections

	"Low" Public	"Low" Public and Private	"Lowering"
Community Colleges	+ 6,545	+ 2,153	+ 3,541
Public Colleges and Universities			
Lower Division	+12,969	+ 5,707	+ 9,074
Upper Division	+10,183	+ 4,824	+ 7,687
Graduate I	+ 788	+ 187	+ 297
Graduate II	+ 2,605	+ 618	+ 984
Total	+26,545	+11,336	+18,042
Private Colleges and Universities			
Lower Division	- 1,399	+27,303	+43,685
Upper Division	- 602	+17,101	+27,361
Graduate	- 577	+ 7,848	+12,559
Total	- 2,578	+52,252	+83,605
Total Enrollment Change	+30,512	+65,741	+105,188

Table 6 - Percent Enrollment Changes, 1976 from Base Projections

	"Low" Public	"Low" Public and Private	"Lowering"
Community Colleges	0.40%	0.13%	0.21%
Public Colleges and Universities			
Lower Division	0.60	0.27	0.42
Upper Division	0.66	0.31	0.50
Graduate I	0.43	0.10	0.16
Graduate II	0.46	0.11	0.17
Total	0.60	0.26	0.41
Private Colleges and Universities			
Lower Division	-0.12	2.31	3.69
Upper Division	-0.09	2.49	3.98
Graduate	-0.13	1.80	2.89
Total	-0.11	2.27	3.63
Total Percent Changes	0.36%	0.78%	1.25%

Table 7 - Total Enrollment Changes, 1980 -- from Base Projections

Community Colleges	+23,834	+ 7,849	+13,423
Public Colleges and Universities			
Lower Division	+47,128	+20,677	+35,095
Upper Division	+37,008	+17,504	+29,726
Graduate I	+ 2,850	+ 673	+ 1,142
Graduate II	+ 9,491	+ 2,243	+ 3,808
Total	+96,477	41,097	+69,771
Private Colleges and Universities			
Lower Division	- 5,085	+99,429	+168,907
Upper Division	- 2,189	+62,334	+105,893
Graduate	- 2,081	+28,524	+ 48,456
Total	- 9,355	+190,287	+323,256
Total Enrollment Change	+110,956	+239,233	+406,450

Table 8 - Percent Enrollment Changes, 1980 -- from Base Projections

Community Colleges	1.40%	0.46%	0.79%
Public Colleges and Universities			
Lower Division	2.12	0.93	1.58
Upper Division	2.33	1.10	1.87
Graduate I	1.52	).36	0.61
Graduate II	1.60	0.38	0.64
Total	2.10	0.90	1.52
Private Colleges and Universities			
Lower Division	-0.42	8.14	13.82
Upper Division	-0.31	8.78	14.91
Graduate	-0.47	6.38	10.84
Total	-0.39	8.00	13.59
Total Percent Change	1.32%	2.76%	4.69%

significantly greater than in 1976. Table 7 shows student enrollment increases from 110,956 to 406,450 or percentage increases of 1.3% to 4.7%. One of the values of the more detailed data classifications in models as contrasted to rudimentary estimates is the identification of changes by type of instiution and level of instruction. For example, graduate enrollment can be seen to be less effected than undergraduate enrollments in both public and private institutions.

One of the objectives identified by many policy-makers is an increase in enrollments for students from families with low income. Table 9 indicates the change in enrollment by parental income in 1976 for the three financing plans. The large increases in the number of student enrollments occur in income level from $9,000 to $19,999. Table 10 shows the percentage change in enrollment by parental income. The large percentage increases occur in income levels up to $7,500. That is, in terms of the number of students effected, more middle income students will attend higher education because of these financing plans, but the low income families will proportionally benefit more than any other group.

Table 11 provides similar data for 1980 which shows substantial increase in the participation of low income students as a result of the financing plans--there are 6% to 9% enrollment increases for families with income up to $7,500 for the actual tuition decreases of alternative three.

Similar classifications of enrollment can be made on the basis of student ability. Table 12 shows the percentage increases for the four ability levels--lowest, low average, high average, highest--as measured by

examinations. Students with low average and highest ability benefit most from the financing plans. Students from the lowest classification apparently do not benefit as much.

Costs

It is desirable to know the estimated increase in costs to the public for the three alternatives. There appear to be two types of increase costs, those from the increased tuition subsidy itself and the costs for the additional enrollment which results from the reduced "price". These are summarized in Table 13. The costs of the tuition subsidy result from the difference between the tuition of the financing plan and the value of the tuition should it have continued to increase at 8% per year. The costs of incremental enrollment were computed based on the 1971-72 average cost per student given by NCFPE, with an 8% annual increase projected from that time.

The annual costs of the tuition subsidy increase in 1976 vary from $501.3 million to $2.7 billion. The costs for the additional enrollment would be from $100 million to $426 million for a total of $601 million to $3.1 billion.

These cost estimates have two assumptions which may reduce the accuracy of these projections. First, the cost by level of student are based on estimates of the cost differentials by the Carnegie Commission on Higher Education. These have not been verified against actual cost data of any large sample of colleges and universities. Second, it is not yet certain how colleges and universities will react to inflation. They could increase tuitions and the use of resources as fast as the costs of salaries, energy and supplies are increasing. On the other hand, because of the presure to

Table 9 - Change in Enrollment by Parental Income, 1976

Parental Income	"Low" Public	"Low" Public and Private	"Lowering"
Less than $3,000	1,221	2,728	4,370
$3,000 - 5,999	3,479	7,931	12,696
$6,000 - 7,499	3,227	7,978	12,764
$7,500 - 8,999	2,528	5,255	8,407
$9,000 - 11,999	6,216	13,899	22,239
$12,000 - 14,999	6,087	11,281	18,045
$15,000 - 19,999	4,752	9,477	15,163
$20,000 and Over	3,002	7,192	11,504
Total	30,512	65,741	105,188

Table 10 - Percent Change in Enrollment by Parental Income, 1976

Less than $3,000	0.45%	1.01%	1.62%
$3,000 - 5,999	0.55	1.26	2.02
$6,000 - 7,499	0.59	1.46	2.33
$7,500 - 8,999	0.33	0.68	1.09
$9,000 - 11,999	0.34	0.76	1.21
$12,000 - 14,999	0.36	0.67	1.08
$15,000 - 19,999	0.36	0.72	1.16
$20,000 and Over	0.22	0.53	0.85
Total	0.36%	0.78%	1.25%

Table 11 - Percent Change in Enrollment by Parental Income, 1980

Less than $3,000	1.59%	3.56%	6.04%
$3,000 - 5,999	1.95	4.44	7.55
$6,000 - 7,499	2.07	5.13	8.72
$7,500 - 8,999	1.16	2.41	4.09
$9,000 - 11,999	1.19	2.66	4.52
$12,000 - 14,999	1.28	2.37	4.02
$15,000 - 19,999	1.28	2.55	4.32
$20,000 and Over	0.78	1.88	3.19
Total	1.32%	2.76%	4.69%

Table 12 - Percent Change in Enrollment by Student Ability

Student Ability	"Low" Public	"Low" Public and Private	"Lowering"
1976			
Lowest	0.26%	0.26%	0.42%
Low Average	0.67	1.30	2.08
High Average	0.31	0.69	1.10
Highest	0.27	0.89	1.43
1980			
Lowest	0.92	0.92	1.56
Low Average	2.37	4.57	7.77
High Average	1.11	2.43	4.12
Highest	0.96	3.15	5.35

Table 13 - Estimated Incremental Annual Costs, 1976 (in millions)

Tuition Subsidy Increase			
Community Colleges	$ 64.6	$ 64.5	$ 137.4
Public Colleges and Universities	406.7	405.3	865.4
Private Colleges and Universities	-0-	771.0	1,712.0
Total	$501.3	$1,240.8	$2,714.8
Costs of Incremental Enrollment			
Community Colleges	14.4	4.7	7.8
Public Colleges and Universities	86.6	34.6	55.1
Private Colleges and Universities	-0-	227.1	363.3
Total	$100.0	$ 266.4	$ 426.2
Total, All Incremental Costs	$601.3	$1,507.2	$3,141.0

hold tuitions, institutions may effectively reduce the real unit costs, as some have appeared to do last year.

Alternative Assumptions

There are, of course, many alternative assumptions which could be made about inflation, cost behavior of institutions and changes in price response by potential students. Perhaps one of the most important and beneficial tasks associated with the use of any model is the accurate and complete definition of these underlying assumptions. For example, the expected behavior of potential students are explicitly identified in terms of price response coefficients. Second, a model permits others to substitute different assumptions or alternatives for evaluation. This use of the model identifies the specific area of difference and facilitates discussion. The evaluation of a wide range of alternatives gives a better appreciation of the underlying mechanisms.

It is also important to note that a model does not test the political feasibility of an alternative. For example, a $3.1 billion annual increase for higher education may be viewed as impossible by some who see federal, state and local governments with austere budgets, yet be considered quite feasible by another who notes that a less than 10% increase in costs to the public would benefit a large number of individuals and society.

The Illinois Model

The Illinois Board of Higher Education's "Access" Model divided institutions into somewhat different categories than the national model, and included the option for state financing plans as well as national financing plans. This was important since the board had a well-developed statistical system with enrollment, tuitions and costs for all institutions and, because of the Illinois State Scholarship Commission, a well-developed state financing plan for students.

The board validated the model by projecting 1974 enrollments using the actual inflation rate, actual tuitions--which had not changed from 1973--and the board's enrollment projections. With the exception of community colleges, the resulting enrollment projections for 1974 were accurate. The community colleges have a greatly expanded general studies program with large increases in enrollment. The validation did, however, provide the reason for the increase in enrollment above projections. Both the public and private institutions in Illinois did not increase tuition for Fall 1974 even though inflation was high, thus reducing the real cost of higher education in the state.

The Evaluated Alternatives

Two alternatives evaluated using the Illinois model were identical to those using the national model. These were constant "low" public tuitions while the tuitions for private institutions were expected to increase at 8% per year, constant "low" tuitions for both public and private institutions, and a decrease in public tuitions by 10% per year. In addition, the board has

been evaluating the Carnegie recommendation for tuitions set at one-third cost for public institutions. This alternative was included for part of the evaluation.

The four alternatives and the base are summarized in Table 14 where the term "low" is interpreted as stable tuition in actual dollars. The 1973-74 actual tuitions and the projected tuitions for each category of institution is given in Table 15. At the present time there is not a tuition differential by level of institution, but there is some discussion of this type of tuition. Each community college district sets its own tuition. For purposes of analysis the board has divided the institutions into those with high tuitions--"high cost" community colleges, and those with low tuitions--"low cost" community colleges.

Evaluation

The projected enrollments for Illinois institutions are given in Table 16. The private institutions are expected to achieve level enrollment during the period 1976-1980, hence the identical projected enrollments for 1976 and 1980. The public universities are expected to achieve level enrollment except for Graduate I enrollments, which are expected to increase slowly. The community colleges are expected to continue their growth, but at a reduced rate. However, the projections are likely to be low for the community colleges based on recent enrollments.

Table 17 summarizes the enrollment changes for each of the four plans for 1976 and 1980. The one-third cost tuition, without any off-setting student aid, causes a reduced enrollment. All other plans increase enrollments, but the enrollments shift between the community colleges and

Table 14 - Tuition Alternatives

	Tuition Changes Per Year	
	Public	Private
1. Base	+ 8%	+ 8%
2. "Low" Public	0	+ 8%
3. "Low" Public and Private	0	0
4. Decreased Tuition	-10%	+ 8%
5. Carnegie	(1/3 cost)	+ 8%

Table 15 - Projected Tuition of an 8% Annual Increase -- Illinois Institutions of Higher Education*

	1973-74 Actual	1976 Projected	1980 Projected
Community Colleges			
High Cost	$405	$472	$642
Low Cost	204	238	324
Public Universities			
Lower Division	567	661	899
Upper Division	567	661	899
Graduate I	567	661	899
Graduage II	567	661	899
Private Institutions			
High Cost, Lower Division	2,416	2,818	3,833
High Cost, Upper Division	2,416	2,818	3,833
High Cost, Graduate	2,416	2,818	3,833
Low Cost, Lower Division	1,543	1,800	2,448
Low Cost, Upper Division	1,543	1,800	2,448
Low Cost, Graduate	1,543	1,800	2,448

*The model provides for different tuition by level since this alternative is being considered by the Illinois Board of Higher Education.

Table 16 - Projected Base Enrollment, Illinois Institutions of Higher Education*

	1976	1980
Community Colleges		
High Cost	109,443	112,564
Low Cost	130,523	134,240
Total	239,966	246,804
Public Universities		
Lower Division	65,666	65,666
Upper Division	63,991	63,991
Graduate I	25,251	25,968
Graduate II	5,485	5,485
Total	160,393	161,110
Private Institutions		
High Cost, Lower Division	31,278	31,278
High Cost, Upper Division	29.141	29,141
High Cost, Graduate	17,306	17,306
Low Cost, Lower Division	15,891	15,891
Low Cost, Upper Division	8,337	8,337
Low Cost, Graduate	1,073	1,073
Total	103,026	103,026
Total Enrollment	503,385	510,940

*Based on projections by the Illinois Board of Higher Education.

Table 17 - Enrollment Changes from Base Projections Illinois Institutions of Higher Education

	"Low" Public	"Low" Public and Private	Decreasing Public	One-Third Cost
1976				
Community Colleges	763	-460	1,351	-4,103
Public Universities	1,151	-137	2,321	-3,215
Private Institutions	-152	2,601	-304	631
Total	1,762	2,004	3,368	-6,687
1980				
Community Colleges	2,767	-1,653	4,694	-5,754
Public Universities	4,057	-501	6,893	-4,428
Private Institutions	-557	9,169	-944	866
Total	6,267	7,015	10,643	-9,316

private institutions through the public universities. Thus, even for comparable total enrollment changes, such as the "low" tuition financing plans, there are marked differences in the community colleges--+763 compared to -460--and in the private institutions--+2,767 compared to -1,653. The model is useful, in this mode, to indicate the enrollment shifts which the various plans would create within the state.

Table 18 presents the resulting enrollments as percentage changes. Because of the different sizes of the educational sectors, the percentage changes are, as expected, significantly different from the actual enrollment changes. While the averages for the total are within 1% for all of the financing plans in 1976 except the one-third cost plan, there are significant changes within sectors. For example, the private institutions change from -0.15% to 2.52% while the states enrollment is vitually unchanged.

Table 19 provides the percent change in enrollment by parental income for 1976 and Table 20 provides similar data by student ability. Because of the extensive student testing program in Illinois, student ability is a particularly important and reliable policy variable.

In order to estimate the costs for implementing these plans, it was important to know both the tuition subsidy and the cost per student for the additional students. Table 21 provides projected cost per student based on the 1973-74 actual costs with 8% per year inflation. These costs were used to produce the second part of Table 22, the estimated incremental annual costs.

The estimated incremental anrual costs include the tuition subsidy increment which would result from decreasing tuitions and the cost of additional students which would be attracted by lower prices. The total cost is given without

Table 18 - Percent Enrollment Changes from Base Projections, Illinois Institutions of Higher Education

	"Low" Public	"Low" Public and Private	Decreasing Public	One-Third Cost
1976				
Community Colleges	0.32%	-0.19%	-0.56%	-1.71%
Public Universities	0.72	-0.08	1.48	-2.00
Private Institutions	-0.15	2.52	-0.30	0.61
Total	0.35%	0.40%	0.67%	-1.33%
1980				
Community Colleges	1.12%	-0.67%	1.90%	-2.33%
Public Universities	2.51	-0.31	4.28	-2.75
Private Institutions	-0.54	8.90	0.92	0.84
Total	1.23%	1.37%	2.08%	-1.82%

Table 19 - Percent Change in Enrollment by Parental Income, 1976, Illinois Institutions of Higher Education

Parental Income				
Less than $3,000	0.47	0.55	0.89	-2.46
$3,000 - 5,999	0.50	0.55	0.98	-2.45
$6,000 - 7,499	0.50	0.61	0.98	-2.43
$7,500 - 8,999	0.29	0.27	0.54	-1.19
$9,000 - 11,999	0.31	0.34	0.58	-1.13
$12,000 - 14,999	0.34	0.33	0.65	-1.10
$15,000 - 19,999	0.36	0.43	0.69	-1.06
$20,000 and Over	0.24	0.39	0.46	-0.62
All Levels	0.35	0.40	0.67	-1.33

Table 20 - Percent Change in Enrollment by Student Ability, 1976, Illinois Institutions of Higher Education

Student Ability				
Lowest Ability	0.32	0.32	0.60	-1.60
Low Average Ability	0.48	0.07	0.91	-1.93
High Average Ability	0.31	0.44	0.60	-0.90
Highest Ability	0.30	0.81	0.59	-0.77
All Levels	0.35	0.40	0.67	-1.33

Table 21 - Estimated Annual Cost per Student, Illinois Institutions of Higher Education

	1974 Actual	1976 Projected	1980 Projected
Community Colleges			
High Cost	$ 1,570	$ 1,831	$ 2,490
Low Cost	1,448	1,68[illegible]	2,297
Public Universities			
Lower Division	1,887	2,201	2,993
Upper Division	3,165	3,692	5,021
Graduate I	4,090	4,771	6,488
Graduate II	14,391	16,786	22,829
Private Institutions			
High Cost, Lower Division	3,710	4,327	5,885
High Cost, Upper Division	4,565	5,325	7,241
High Cost, Graduate	6,114	7,131	9,699
Low Cost, Lower Division	2,245	2,619	3,561
Low Cost, Upper Division	2,569	2,996	4,075
Low Cost, Graduate	3,522	4,108	5,587

Table 22 - Estimated Incremental Annual Costs, 1976 (in millions)

	"Low" Public	"Low" Public and Private	Decreasing Public
Tuition Subsidy Increase			
Community Colleges	$11.8	$11.8	$18.0
Public Universities	15.1	15.1	24.2
Private Institutions	-0-	37.7	-0-
Total	$26.9	$64.6	$42.2
Costs of Incremental Enrollment			
Community Colleges	$ 1.4	-0-	$ 3.0
Public Universities	4.1	-0-	8.2
Private Institutions	-0-	12.2	-0-
Total	$ 5.5	$12.2	$11.2
Total, All Incremental Costs	$32.4	$76.8	$53.4

regard to the source of funds. These could be both public and private institutions through the Illinois State Scholarship Commission, to the institutions through an institutional grant program, or potentially through cost savings or a combination of sources. Costs were not estimated for the one-third cost tuition plan since it was not feasible to determine whether cost savings could be achieved. Because of the relatively small number of students lost at any institution and the observed difficulty for an institution to reduce costs with enrollment decreases, it was assumed that no cost savings would occur when there were enrollment decreases.

These costs should be used as estimates with large potential variances depending upon institutional responses. However, unlike the national model, there are valid unit cost data available by level because of the historical unit cost studies which have been done in Illinois for almost a decade.

State Use

The Illinois model is being used for the evaluation of more complex financing plans than those illustrated here. Because of Illinois historical interest in costs, tuitions and student financing, the financing mechanisms in Illinois are more complex than in most states. The board, making policy at the state level, is aware that financial policy is one of the few state level policies which directly effects student enrollments, and carefully evaluates alternative financing plans for their effects on each of the institutional categories.

APPENDIX - PRICE RESPONSE COEFFICIENTS

Price Response Coefficients

Price response coefficients are mathematical representations of a consumer's decision to purchase a product and arise from traditional economic theory. Their use in higher education to study the enrollment impacts of different levels of tuition has been rather recent. This is not because the theory was not available, but rather because the data were not available.

Recent studies by Radner and Miller, Kohn Manski, and Mundel, Barnes, Erickson, Hill and Winokur, Corrazzini, Dugan, and Grabokski and Hoenack and Weiler have added significantly to our knowledge of the price response coefficients for higher education. Their work is summarized in a NCFPE staff report (see Reference #1). From the report, the following comments were made:

> These five studies indicate that the proportion of the eligible population attending college or that the probability an individual attends college increases with family income and decreases with the cost of attendance (defined in a variety of ways). The results are also consistent in that the price and income effects are significantly different from zero statistically.
>
> It is difficult, unfortunately, to compare the magnitude of the price and income effects across the different studies. ...Some rough calculations indicate that the price response coefficients range between one and five percent for a $100 change in price. That is, if tuition decreases by $100, then enrollment would increase by one to five percent, depending on the type of institution and on the income level of the particular population segment.

Although there are some major research efforts underway, there is still some concern both about the use of price response coefficients to represent student behavior, and the value of the particular price response coefficients which are being used in models today.

Grants, Loans and Work Study

An assumption made by most models is that the price response of a student is the same regardless of whether tuition is reduced, the student receives a grant (e.g. scholarship), takes out a student loan, or participates in the college work study program. Since loans incur a long term debt--which has certain disutility--and college work study requires the dedication of the student's time, it is reasonable to believe that these have less utility or value to a student than a grant for an equal amount of money. Yet this assumption has been made by model builders since no data was available to support a differentiation by type.

A recent study by Carlson (see Reference #5) compared price response coefficients of grants, work study and loans. While there are certainly differences in the sample of students, the results show a preference for grants, then loans and then work study for public institutions where the amounts are likely to be somewhat less than private institutions. For private institutions work study was preferred to loans by students with low family incomes. The results of his study are summarized in Table A-1. Price response coefficients for several different grant programs were compared--tuition grants of the Illinois State Scholarship Commission, New York tuition waivers and the federal SEOG program. The results, particuarly for students with low family incomes at public institutions are quite comparable. The results are given in Table A-2.

From the students' point of view, then, grants are preferable to tuition loans or work study. That is, a grant for a given amount is more likely to cause a student to decide to enter higher education than a loan or a work study

Table A-1 - Student Response to Federal Aid Programs, 1973-74

Type Institution	Family Income	Student Price Response, %/$100 Grants	Work-Study	Loans
Public				
	Low	2.17%	0.99%	1.17%
	Middle	0.24	0.19	0.30
	High	--	0.02	0.03
Private				
	Low	3.40	2.00	1.88
	Middle	0.30	0.38	0.54
	High	--	0.04	0.08

Table A-2 - Student Response to Grant Programs*

Type Institution	Family Income	Student Price Response, %/$100 Illinois Scholarship	New York Tuition Waiver	Federal SEOG
Public				
	Low	2.14%	2.45%	2.17%
	Middle	1.90	1.16	0.24
	High	0.62	0.87	--
Private				
	Low	2.40	4.28	3.40
	Middle	2.35	1.38	0.30
	High	1.98	0.73	--

*The Illinois State Scholarship Commission provides grants for tuition and required fees based on a needs test. New York City provides $1,000 tuition waiver. The Federal SEOG is a need-based program for which almost all high income families would be ineligible.

for the same amount. It is likely that these differences, if the results are shown to apply to more general samples, will be incorporated into financing models.

From the public point of view, however, grants may be less effective than loans or work study. The government only has to pay for loan defaults and interest subsidies rather than the principle of the loan. Since work study must be matched by an employer's contribution (the federal government pays not more than 80% and typically less than two-thirds of the wages received by the student), the amount received by a student is greater than the cost to the federal government.

A set of example calculations using the student price response coefficients for low income students at public institutions may illustrate this point. A public expenditure of $100 per student will pay for one $100 grant, so that the availability of a $100 grant would be expected to increase enrollment of low income students in public institutions by 2.17%. Assuming that one-fourth of the student loans are defaulted with no enrollment and $20 is used for interest subsidy for each $100 loan, then $100 would be expected to support $222 of student loans. Although the student price response coefficient is less--1.17% as compared to 2.17%--the available funds are 2.22 times as large yielding an effective 2.59% increase in enrollment for $100 per student. Assuming that an employer contributes one-third to work study, and that the institution does not indirectly otherwise benefit from college work study, students work at less than market wages, then $100 would provide $150 in work study. This would be 1.5 times 0.99% giving an effective 1.49%. These values are summarized in Table A-3.

Table A-3 - Student Financial Aid per $100 of Public Expenditure

Type	Amount	Example Price Response Coefficient*	Effective Response
Grant	$100	2.17%	2.17%
Loan	222	1.17	2.59
Work Study	150	.99	1.49

*For low family income at public institutions.

These calculations are only an example of how the public policy on loans, grants, and work study is much more complex than recommending grants because they have a higher price response coefficient.

Cross-Response

Another aspect of price response coefficients representing student behavior is the indirect price responses, or as described by economists, the cross-elasticity of students who elect to attend a different type of institution rather than not attend the specific institution under consideration when the price is increased. Referring to the price response coefficients of Table 1, if tuition were increased at a public four-year institution by $100, 3.13% of the lower division, low income students would be expected to "drop out" of that institution. However, 0.51% would be expected to enroll in community colleges, 0.22% would attend private two-year colleges and 0.16% would attend private four-year institutions. Thus the actual enrollment decline, for the state and nation as a whole, would only be 2.24%--3.13% less 0.89% attending other higher education institutions. For this reason, changing the price for a state as a whole does not have the same percentage impact as changing a single institutions. Had the tuition example above been a single institution in Illinois, that institution would have had a decline of 3.13%--rather significant for an institution. Yet the average institution in Illinois is less than 1% of the state total so that the impact on the state would be less than 0.02%--almost unidentifiable in statewide statistics.

From this example, it is clear that enrollments will decline as tuitions increase, with the declines primarily in the private institutions where students will leave to go to public institutions, and increases in the

community colleges where students from the public universities will attend as some other community college students leave. Thus a general tuition increase will tend to increase community college enrollments and increase enrollments in private institutions. Since public universities both gain and lose students due to general price changes, they will have smaller net enrollment changes.

It is important to consider the sum of all of these changes, and the specific nature of a tuition change--a single institution, a type of institution or a general increase--to understand the likely effects of these changes.

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